

Addenda #88 – August 2025

Re: Ch. 8, 2050 Net-Zero Emissions; Impossible!!

SDG 7 – Ensure access to affordable, reliable, sustainable and modern energy for all

North Atlantic wind farms face critical fatigue risk, report warns

TGS | 4C Offshore; July 14, 2025

Offshore wind turbines in the North Atlantic are at risk of failing years before the end of their expected lifespan, a new report has warned.

The findings, published by London-based Lloyd's Register, showed that the joints of some support structures, such as jacket foundations, can experience enough wear to reduce their service life by as much as a third.

The case study evaluated a North Atlantic offshore wind farm comprising 60 to 70 turbines, typically designed for 25 years of commissioning with a fatigue design factor of three, equating to a 75-year minimum fatigue life.

The study found that a critical joint in the jacket foundation would reach its fatigue limit after just 52 years.

Wind turbines are ageing – what happens next?

Power-technology.com; March 18, 2024

With an average lifespan of 25 years, a high proportion of wind turbines across the world are approaching retirement.

Wind turbines are not always decommissioned immediately after their working life. Depending on their condition and functionality, they are sometimes refurbished or allowed to continue operating (albeit less efficiently) until they become economically unfeasible.

How sustainable are offshore wind turbines to build, and how long do they last?

North Coast Offshore Wind;

The expected life expectancy of an offshore wind turbine is approximately 20 to 30 years. In 2016, the British company Vattenfall successfully decommissioned (2) some of the first offshore wind turbines ever installed after two decades of operation. Once a turbine is decommissioned, the site can either be “repowered,” in which a new turbine is placed there, or infrastructure can be fully removed, or allowed to remain in place to act as artificial reefs, and the site abandoned.

The 20-Year Lifespan of Wind Turbines: What It Means for Sustainability

Green Fingers; March 7, 2025

Wind turbines, a central component of the global push for renewable energy, have an operational lifespan of approximately 20 years. As these turbines age, questions regarding their future loom large. Are they destined for landfills, or can they be refurbished, repowered, or recycled? This challenge has significant implications for the sustainability of renewable energy infrastructure worldwide.

These concerns have become more pressing as wind farms across Europe, the United States, and other regions approach or exceed the 20-year mark. Studies indicate that if no recycling measures are implemented, millions of tonnes of turbine waste could end up in landfills by 2050.

Fact #1: Wind farms, especially those built in the ocean, don't last forever.

Fact #2: As wind turbines age, their output decreases, just as solar panels do.

Fact #3: When wind farms are no longer “economically feasible”, developers have 2 choices
decommission and deconstruct = loss of power to the grid, recycling challenges
repower (replace) = a *very* expensive process

Wind speed is the critical factor in determining the output of an offshore wind farm. This was demonstrated in Addenda #85 – August 2025, where the output of all UK wind farms combined fluctuated between 74% and 3% of installed capacity (rated output). Offshore wind projects tend to have higher capacity factors, often exceeding 45%, compared to onshore projects averaging around 35-40%. The Empire Wind 1 wind farm currently under construction 15 miles off Long Island, NY, will provide electricity directly to the New York City electrical grid. This project has an *installed* capacity rating of 816 MW and has been promoted as being capable of powering 500,000 New York homes...

That's *if* all 54 wind turbines are running at their full 15 MW capacity, at all times.

If Empire Wind 1 was operational and running at a 45% capacity factor, then it would only be capable of fully powering 225,000 New York homes, not the 500,000 promoted. Or it would only be capable of providing *less than half* the electricity needed to power all of those 500,000 homes... To provide less than half the lighting you need to see in the dark, to power the appliances needed to cook and heat your food, to keep your food from spoiling and your drinks cold, to charge your phones and electronics so you can communicate with others, to heat your house in the winter or cool it in the summer...

As Empire Wind 1 ages, its output will decrease by about 12% over its 20-year life span, providing even less electricity to power increasing loads required to meet New York's 'electrification' mandates. At the end of that 20-year lifespan, Empire Wind 1 will face decommission or repowering. The cost to purchase, transport and install an offshore wind turbine runs between \$2,000 and \$3,000 per kW. Replacing the 15-MW wind turbine generators installed in Empire Wind 1 would cost between \$30 million and \$45 million *each*, before figuring any bulk purchase discounts or financing. Both options will cost ratepayers hundreds of millions in additional costs, requiring double digit rate hikes every three years, without end, to continually maintain and replace those turbines.

In contrast to the short lifespan of wind turbines, nuclear and natural gas power plants can operate for more than 50 years. The Nine Mile Point nuclear power plant in Scriba, New York, is America's oldest working nuclear power plant. Reactor Unit #1 has been operational since December 1969, 56 years ago. There are 61 power plants in New York that burn natural gas as their primary, or only fuel source to generate electricity. More than half of them were built before 1996 and the oldest was built in 1952.

So in answer to the question *How sustainable are offshore wind turbines...* not very. They're expensive to build and maintain, they have a short life span and they have to be replaced at even higher costs.